

CLAIMS

1. Jet injector for injecting a liquid medical drug through the skin of a person to be treated comprising a housing (1) to be pressurized and holding said medical drug and which is defined by an enclosing periphery wall (3) and a bottom wall (4) having an internal surface (5) facing the interior of the housing and an opposite external surface (6), the bottom wall (4) has at least one through passage (7) extending between said internal and external surfaces and through which, when the injector is used, said medical drug is expelled from the housing (1) and transformed into a thin jet stream (18) penetrating the skin of said person, c h a r a c t e r i z e d in that said through passage (7) includes a flow confining restriction (12 and 39,28) to develop a high pressure in the medical drug expelled from the housing (1), in that a body (10) is connected to said passage (7), said body (10) is tapering in a direction away from the passage (7) and terminates in a point (14), and in that said body (10) has a periphery surface (40) receiving the expelled medical drug and guiding it towards said point (14) to create a coherent jet stream emerging from said point (14).
2. Jet injector according to claim 1, wherein said bottom wall (4) has a through, truncated cone-shaped aperture (8) defined by a wall (12), wherein an insert (9) having an essentially cone-shaped body (10) is arranged to be inserted into said housing (1) such that a portion (13) of said cone-shaped body (10), the periphery wall (39) of which is essentially congruent to said aperture wall (12), is received in said aperture (8) and wherein at least one passage (7) is established between said portion (13) of said cone-shaped body (10) and the aperture wall (12) through which the medical drug is expelled from the housing (1), said drug then flows along said essentially cone-shaped body (10) to be delivered

from said point (14) of the cone-shaped body (10) as a coherent, thin jet stream (18).

3. Jet injector according to claim 1 or 2, wherein at least a part of a point (14) portion of said  
5 essentially cone-shaped body (10) has a concave periphery surface (40).

4. Jet injector according to claim 2, wherein said periphery surface (40) of said essentially cone-shaped body (10), from its point (14) to said passage (7), is  
10 concave.

5. Jet injector according to any of the preceding claims, wherein said essentially cone-shaped body (10) is terminated in a sharp point (14).

6. Jet injector according to any of the preceding  
15 claims, wherein a positioning element (19) protrudes from said bottom wall (4) and terminates at a level beyond or at said point (14) of the essentially cone-shaped body (10), said positioning element (19) is intended to be placed on the skin of the person to be treated when  
20 injecting the medical drug.

7. Jet injector according to claim 6, wherein said periphery wall (3), bottom wall (4) and positioning element (19) of the jet injector are made in one piece of resin, preferably polycarbonate plastic.

25 8. Jet injector according to any of the preceding claims, wherein said insert (9) is said essentially cone-shaped body (10), the base (20) of which is positioned at the level of said internal surface (5) of the bottom wall (4), when the injector is assembled.

30 9. Jet injector according to any of claims 1 to 8, wherein said insert (9) comprises a head body (21) arranged to be inserted in said housing (1) close to said bottom wall (4) and connected to said essentially cone-shaped body (10).

35 10. Jet injector according to claim 9, wherein said head body (21) and the essentially cone-shaped body (10)

are made in one piece of resin, preferably polycarbonate plastic.

11. Jet injector according to any of the preceding claims, wherein said bottom wall (4) is perforated by a  
5 single aperture (8) centrally positioned on a symmetry axis (11) of said housing (1), said point (14) of the essentially cone-shaped body (10) being positioned on said symmetry axis (11) when assembled.

12. Jet injector according to any of claims 2-11,  
10 wherein a number of spacing means (27) are provided between said insert (9) and said bottom wall (4) and/or between said insert (9) and said aperture wall (12), whereby a ring-shaped gap is formed between the periphery surface (39) of said essentially cone-shaped body (10)  
15 and the aperture wall (12).

13. Jet injector according to claim 12, wherein said spacing means (27) are positioned between said internal surface (5) of the bottom wall (4) and an opposite surface (24) of said head body (21).

20 14. Jet injector according to claim 13, wherein said spacing means (27) are protrusions projecting from said internal surface (5) of the bottom wall (4) and/or from said surface (24) of the head body (21).

15. Jet injector according to claim 12, wherein said  
25 spacing means (27) are positioned between said periphery surface (39) of the essentially cone-shaped body (10) and said aperture wall (12).

16. Jet injector according to claim 15, wherein said  
30 spacing means (27) are protrusions projecting from said periphery surface (39) and/or said aperture wall (12).

17. Jet injector according to claims 14 and 16, wherein said spacing means (27) are bosses, pins, studs, ribs, ridges or the like integrated in the surface/wall (5,24;39,12) from which they project.

35 18. Jet injector according to any of claims 2-11, wherein said passage (7) is a number of grooves (26) formed in said aperture wall (12) and/or in said

periphery surface (39) of the essentially cone-shaped body (10).

19. Jet injector according to claim 18, wherein a number of flutes (25) are formed in a surface (22) of  
5 said head body (21) facing said periphery wall (3) of the housing (1) and in its surface (24) facing said bottom wall (4), said flutes (25) having a section area larger than that of said grooves (26), said flutes (25) passing  
10 pressurized medical drug from the interior of said housing (1) into relevant ones of said grooves (26).

20. Jet injector according to any of claims 2-11, wherein said insert (9) is a hollow body confined by a pliable, elastic thin-walled shell (29), said shell (29) being adapted to deflect when subjected to pressurized  
15 medical drug such that a gap (32) is temporarily formed between the cone-shaped body (10) and said aperture wall (12) admitting a medical drug flow therebetween.

21. Jet injector according to any of claims 2-11, wherein a pliable, elastic wall (33) formed as a  
20 truncated funnel is depending from said bottom wall (4) and constitutes said aperture (8), the upper part of said pliable wall (33) having a number of blind grooves (36) and being adapted to deflect when subjected to  
pressurized medical drug such that a gap is temporarily  
25 formed between the cone-shaped body (10) and said pliable wall (33) admitting a medical drug flow therebetween.

22. Jet injector according to any of claims 2-11, wherein said essentially cone-shaped body (10) is solid and said body (10) and said aperture (8) is manufactured  
30 with coarse tolerances, said passage (7) being formed by gaps (28) occurring between said periphery surface (39) of the body (10) and said aperture wall (12).

23. A method for producing a jet injector for  
injecting a liquid medical drug through the skin of a  
35 person to be treated comprising a housing (1) to be pressurized and holding said medical drug and which is

defined by an enclosing periphery wall (3) and a bottom wall (4) having at least one through passage (7), characterized by following steps of:

- 5 (i) providing a mould for injection moulding of said periphery wall (3) and bottom wall (4) and a through aperture (8) in said bottom wall (4);
- (ii) machining portions of the wall of the mould forming an internal surface (5) of said bottom wall (4) and/or said aperture (8) of the bottom wall (4) such that  
10 recesses are created in the wall of the mould, eg by milling, cutting, engraving, spark machining or etching;
- (iii) injection moulding, whereby protrusions (27) are formed on said internal surface (5) and/or on a wall (12) of said aperture (8);
- 15 (iv) providing a mould for injection moulding of an insert (9) having an essentially cone-shaped body (10) intended to be received in said aperture (8) and having a periphery surface (39) essentially congruent to said wall (12) of the aperture (8);
- 20 (v) in addition to or instead of step (ii) machining portions of the wall of the mould forming said periphery surface (39) such that recesses are created in the wall of the mould, eg by milling, cutting, engraving, spark machining or etching;
- 25 (vi) injection moulding, whereby protrusions (27) are formed on said periphery surface (39); and
- (vii) positioning said essentially cone-shaped body (10) into said aperture (8) by inserting said insert (9) into said housing (1), its point (14) first, so that said  
30 protrusions (27) contact an opposite surface (39) or wall (12), thereby creating a passage (7) designed as a substantially ringshaped gap between said aperture wall (12) and said periphery surface (39) of the essentially cone-shaped body (10).
- 35 24. A method for producing a jet injector for injecting a liquid medical drug through the skin of a person to be treated comprising a housing (1) to be

pressurized and holding said medical drug and which is defined by an enclosing periphery wall (3) and a bottom wall (4) having at least one through passage (7), characterized by following steps of:

- 5           (i) providing a mould for injection moulding of said periphery wall (3) and bottom wall (4) and a through aperture (8) in said bottom wall (4);
- (ii) injection moulding,
- (iii) machining a wall (12) of said formed aperture
- 10       (8) such that grooves (26) are created in said wall (12), eg by milling, cutting, engraving or etching, said grooves extending from an internal surface (5) of said bottom wall (4) to its external surface (6);
- (iv) providing a mould for injection moulding of an
- 15       insert (9) having an essentially cone-shaped body (10) intended to be received in said aperture (8) and having a periphery surface (39) essentially congruent to said wall (12) of the aperture (8);
- (v) in addition to or instead of step (iii)
- 20       machining said periphery surface (39) such that grooves (26) extend from an internal surface (5) of said bottom wall (4) to its external surface (6), when said insert (9) is positioned into said aperture (8) according to step (vi);
- 25       (vi) positioning said essentially cone-shaped body (10) into said aperture (8) by inserting said insert (9) into said housing (1), its point (14) first, so that said periphery surface (39) of the cone-shaped body (10) contacts said wall (12) of the aperture (8) creating a
- 30       passage (7) designed as a number of tube-like flow paths between said aperture (8) and said body (10).

25. A method for forming a thin jet stream (18) of a liquid medical drug for injection into a target by means of a jet injector comprising a housing (1) to be

35       pressurized and holding said medical drug and which is defined by an enclosing periphery wall (3) and a bottom wall (4) having an internal surface (5) facing the

interior of the housing and an opposite external surface (6), the bottom wall has at least one through passage (7) extending between said internal and external surfaces and through which, when the jet injector is used, said

5 medical drug is expelled from the housing, c h a r a c t e r i z e d by following steps of:

(i) pressurizing said housing (1) to expel said medical drug from the housing (1) and through said passage (7);

10 (ii) restricting the flow of said medical drug from said housing (1) to develop a high pressure in the medical drug flowing from said passage (7);

(iii) guiding the outflowing medical drug to an essentially cone-shaped body (10) provided on said jet  
15 injector and connected to said passage (7), said body (10) is tapering in a direction away from the passage (7) and terminates in a point (14);

(iv) causing the expelled medical drug to flow (16) along a periphery surface (40) of said body (10) towards  
20 its point (14);

(v) focusing, at said point (14), the expelled medical drug into a homogeneous flow (17); and

(vi) forming a coherent jet stream (18) emerging from said point (14).

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